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मानक

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Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

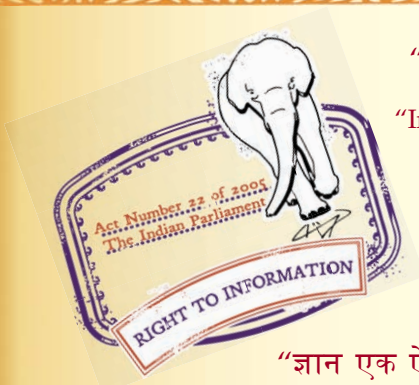
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 101-6-1 (1988): Methods of sampling and test for paints, varnishes and related products, Part 6: Durability tests, Section 1: Resistance to humidity under conditions of condensation [CHD 20: Paints, Varnishes and Related Products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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AMENDMENT NO. 1 SEPTEMBER 1990
TO
IS 101 (Part 6/Sec 1) : 1988 METHODS OF SAMPLING
AND TEST FOR PAINTS, VARNISHES AND
RELATED PRODUCTS

PART 6 DURABILITY TESTS

Section 1 Resistance to Humidity Under Conditions of
Condensation

(Third Revision)

(Page 2, clause 2.2, informal table) — Substitute the following for the existing matter pertaining to 'Up to 12':

(1)	(2)
Up to and including 10	17 to 22
Above 10 to 11	22 to 27
Above 11 to 12	27 to 34'

(CHD 20)

AMENDMENT NO. 2 JUNE 1997
TO
IS 101 (Part 6/Sec 1) : 1988 METHODS OF SAMPLING
AND TEST FOR PAINTS, VARNISHES AND RELATED
PRODUCTS

PART 6 DURABILITY TESTS

Section 1 Resistance to Humidity Under Conditions of
Condensation

(Third Revision)

(Page 1, clause 2.1.1) — Substitute the following for the existing clause:

'2.1.1 Metal panels — Unless the thickness and the type of panels specified or agreed the test panels shall be of mild steel as prescribed in 2 of IS 101 (Part 1 /Sec 3) : 1986 'Methods of sampling and test for paints, varnishes and related products: Part 1 Tests on liquid paints (general and physical), Section 3 Preparation of panels'.

(CHD 020)

AMENDMENT NO. 3 MAY 2003
TO
IS 101 (PART 6/SEC 1) : 1988 METHODS OF
SAMPLING AND TEST FOR PAINTS, VARNISHES AND
RELATED PRODUCTS

PART 6 DURABILITY TESTS

Section 1 Resistance to Humidity under Conditions of Condensation

(Third Revision)

(*Page 2, clause 2.2, line 2*) — Insert the following between the words ‘steel panel’ and ‘to give’:

‘so that the variation in dry film thickness (DFT) is within ± 10 percent.’

(CHD 20)

4088 BIS/08—1

Indian Standard

METHODS OF SAMPLING AND TEST FOR
PAINTS, VARNISHES AND RELATED PRODUCTS

PART 6 DURABILITY TESTS

Section 1 Resistance to Humidity Under Conditions of Condensation

(Third Revision)

1. Scope — Prescribes methods for determination of resistance to humidity under continuous condensation. Also covers methods on neutral and artificial salt spray tests.

2. Resistance to Humidity

2.0 Outline of the Method — This test is carried by suspending the painted panel after specified period of drying in a corrosion cabinet maintained at 100 percent relative humidity and a temperature cycle of 42 to 48°C for seven days and examining it for any signs of deterioration and corrosion of metal surface.

2.1 Apparatus

2.1.1 Metal panels — of mild steel as prescribed in 2 of IS : 101 (Part 1/Sec 3)-1986 'Methods of sampling and test for paints, varnishes and related products: Part 1 Tests on liquid paints (general and physical) , Section 3 Preparation of panels'.

2.1.1.1 The panels shall be prepared as prescribed in 2.1.1 and 2.1.2 of IS : 101 (Part 1/Sec 3)-1986.

Note — Results of tests carried out on different substrates do not necessarily correlate.

2.1.2 Corrosion cabinet — The apparatus consists of a closed cabinet in which the relative humidity is maintained at approximately 100 percent and the temperature cycles continuously over a range of 42 to 48°C, thereby ensuring that copious condensation occurs on test panels positioned vertically within the cabinet.

Note 1 — Should the cabinet be copper lined, the copper shall be tinned or coated with a suitable organic coating to prevent dissolution of small amounts of copper in water.

Note 2 — The design and dimensions are left to the user's discretion provided that the following conditions are observed:

- a) Humidification — The humidity shall be maintained by evaporation of water from a reservoir covering (or situated in) the bottom of the cabinet.
- b) Water — Fill the water tank at the bottom of the oven to a depth of 45 mm with distilled water. The water level in the tank shall be adjusted to the same level daily; and water shall be maintained free from grease or oil.
- c) Heating — The cabinet shall be heated through the medium of water by a heater placed immediately below the water reservoir, or preferably by a heater completely immersed in water.
- d) Temperature cycle — The heater shall be controlled by two thermostats (placed in the air space above the water) in such a way that the temperature of the air space cycles continuously from 42 to 48°C and back to 42°C in not less than 45 minutes and not more than 75 minutes. The time required for heating and cooling shall be approximately equal.
- e) Air circulation — The air in the cabinet shall be circulated by means of a fan in such a way that the temperature in any part of the air space does not differ by more than 1°C at any given moment. Necessary particulars of the fan are given below:

Blades	Two
Fan diameter	150 mm
Fan width	25 mm at edge
Diameter of the shaft	6.75 mm
Height of the fan from the bottom	180 mm
Fan diameter at the pulley	15 mm
Speed	1 440 rev/min, approximately

Adopted 29 April 1988

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Gr 3

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Paints and Allied Products Sectional Committee, CDC 8; Panel for Methods of Test, CDC 8 : 6 : 4 [Ref : Doc : CDC 8 (9332)]

IS : 101 (Part 6/Sec 1) – 1988

- f) *Spacing of test panels* — If the panels hang in the cabinet, the hooks and rods from which they are suspended shall be made of glass or plastics. If the panels are placed on metal racks, they shall be suitably insulated at their points of contact with the rack. It shall be ensured that all the panels are strictly vertical. The panels shall not be placed less than 37 mm apart or less than 37 mm from any side of the cabinet.
- g) *Ambient conditions* — The cabinet conditions shall be controlled [to give cycles as required in (d) above] at room temperature.
- h) *Rotating of panel rack* — In view of the fact that the circulating fan is located on one side only, it is necessary to turn the panel rack every day to ensure uniformity in actual working.

The cabinet shall be opened once only every 24 hours for rotation of panels and maintenance of water level.

2.2 Procedure — The metal panel is cleaned and prepared as prescribed in 2.1.1.1. Apply one coat of paint on both sides of the mild steel panel to give a dry film weight of the material as follows:

<i>Weight of the Wet Material kg/10 litres</i>	<i>Limits of Dry Film Weight g/m²</i>
Up to 12	27 to 34
Over 12 and up to 14	34 „ 44
„ 14 „ 16	44 „ 54
„ 16 „ 18	54 „ 68
„ 18	68 „ 80

2.2.1 Keep the painted panel in a vertical position at room temperature for 24 hours to air-dry, and then at a temperature of 60 to 65°C for one hour or stove for the specified period. Cool the panel to room temperature and protect the edges to a depth of 5 mm with a suitable protective composition* which shall have melting point above 50°C, and then suspend it vertically in the corrosion cabinet.

2.2.2 After exposure under these conditions for seven days, remove the panel and examine for signs of deterioration of paint film. Remove 25 mm strip of the film from the centre of the panel carefully with a non-corrosive paint remover neglecting 25 mm portion of the exposed surface from each end and examine the exposed metal for signs of corrosion. The metal surface shall show no sign of corrosion; changes in appearance and condition of the paint film shall not be taken into consideration in deciding about acceptability.

Note — Immediately after the assessment is made, the exposed area shall be protected with a suitable non-corrosive transparent lacquer for reference purposes.

3. Neutral Salt Spray Test

3.1 This standard prescribes a method for determining the resistance of coatings to the neutral salt spray test performed in accordance with the requirements of coating or product specifications.

3.2 Apparatus

3.2.1 Spray cabinet — It shall be made of, or lined with, a material resistant to corrosion by the sprayed solution. The cabinet shall have a capacity of not less than 0.4 m³ since, with smaller volumes, difficulties are experienced in ensuring even distribution of spray. The ceiling or cover shall be sloped upwards at an angle of not less than 25° to the horizontal so that drops of solution which accumulate on it do not fall on the panels being tested.

The size and shape of the cabinet shall be such that the quantity of solution collected in the collecting device (see 3.2.4) is within the limits stated in 3.5.2.2.

Cabinets with a volume greater than 2 m³ will be difficult to operate unless careful consideration is given to their design and construction. Factors which should be taken into consideration are given as follows:

- a) The number and the positioning of the atomizers and baffles required to produce an even spray distribution within the limits specified in 3.5.
- b) The number of collecting devices required to monitor the spray as required in 3.2.4.
- c) The heating, insulation and means of temperature control required to produce a uniform temperature within the cabinet at all positions where test specimens are exposed.

*Preferably consisting of 3 parts by weight of paraffin wax (melting point 60°C) and 1 part by weight of carnauba wax (melting point 182°C).

- d) The design of the ceiling (for example, a false ceiling) needed to prevent drops of solution falling on to the test panels if the size of the chamber does not allow an angle of 25° as required in 3.2.1.

3.2.2 Means of supply and controlling the heat — The heat shall be adequate to maintain the cabinet and its contents at specified temperature (see 3.5.2.1). The temperature shall be controlled by a thermostat element placed either within the cabinet, at least 100 mm from the walls or in a water jacket on the cabinet. In either case, a thermometer capable of being read from the outside, shall be placed wholly within the cabinet at least 100 mm from the walls or the cover.

3.2.3 Means of spraying the salt solution — It shall comprise a supply of clean air of controlled pressure and humidity, a reservoir to contain the solution to be sprayed and one or more atomizers made of material resistant to the solution.

The compressed air supply to each atomizer shall be passed through a filter to remove all traces of oil or solid matter and shall be at a pressure of 70 to 170 kPa. In order to prevent evaporation of the sprayed droplets, the air shall be humidified before entering each atomizer by passage through a saturation tower containing water at a temperature several degrees celsius higher than that of the cabinet. The appropriate temperature depends on the pressure used and the type of atomizer nozzle, and shall be adjusted so that the rate of collection of spray in the cabinet and the concentration of the collected spray are kept within the specified limits (see 3.5.2.2).

The reservoir to contain the solution to be sprayed shall be a tank made of material resistant to the solution and shall be provided with means of maintaining a constant level of solution in the reservoir.

The atomizers shall be made of inert material, for example, glass or plastics. Baffles may be used to prevent direct impingement of spray on test specimens, and the use of adjustable baffles is helpful in obtaining uniform distribution of spray throughout the cabinet.

Note — In order to avoid a build up of pressure within the cabinet (3.2.1), it is a common practice to vent the apparatus to the atmosphere outside the laboratory.

3.2.4 Collecting device — At least two, of glass or other chemically inert material (see Note 1). The collecting devices shall be placed in the zone of the cabinet where the test specimens are placed, one close to an inlet of spray and one remote from an inlet. They shall be so placed that only spray and not liquid falling from test panels or from parts of the cabinet is collected.

Note 1 — Glass funnels with the stems inserted into graduated cylinders have been found to be suitable collecting devices. Funnels with a diameter of 100 mm have a collecting area of approximately 80 cm².

Note 2 — If two or more atomizers are used, the number of collecting devices should be at least twice the number of atomizers.

3.2.5 If the equipment has been used for a spray test or for any other purpose with a solution differing from that specified for this test, it shall be thoroughly cleaned before use.

3.3 Test Solution

3.3.1 The test solution shall be prepared by dissolving sodium chloride in distilled or demineralized water to produce a concentration of 50 ± 5 g/l. The sodium chloride shall be white, of minimum assay 99.6 percent (m/m), and substantially free from copper and nickel; it shall contain not more than 0.1 percent (m/m) of sodium iodide. If the pH of the solution is outside the range 6.0 to 7.0, the presence of undesirable impurities in salt or water or both shall be investigated.

3.3.2 The pH of the salt solution (3.3.1) shall be adjusted so that the pH of sprayed solution collected within the test cabinet (see 3.2) shall be between 6.5 and 7.2. Control of pH shall be based on electrometric measurement at 25°C but a short-range pH paper which can be read in increments of 0.3 pH unit or less and which has been calibrated against electrometric measurements may be used in routine checks. Any necessary correction shall be made by addition of solution of hydrochloric acid or sodium hydroxide of analytical grade.

Note — Attention is drawn to the possible changes in pH resulting from loss of carbon dioxide from the solution when it is sprayed. Such changes may be avoided by reducing the carbon dioxide content of the solution by, for example, heating it to a temperature above 35°C before it is placed in the apparatus or by making the solution from freshly boiled water.

3.3.3 The solution shall be filtered before it is placed in the reservoir of the apparatus in order to remove any solid matter which might block the apertures of the spraying device.

3.4 Test Panels

3.4.1 Material and dimension — Unless otherwise specified or agreed, the test panels shall be of burnished steel and approximately 150 × 100 mm.

4088 BIS/08-5

IS : 101 (Part 6/Sec 1) - 1988

3.4.2 Preparation and coating — Prepare the test panels in accordance with IS : 101 (Part 1/Sec 3)-1986 unless otherwise specified, and then coat them by the specified method with product or system under test.

The back and the edges of the panel shall be coated with product or system under test, unless otherwise specified.

Note — If the coating on the back and the edges of the panel differs from that of the product under test, it should have a resistance greater than that of the product under test.

3.4.3 Drying and conditioning — Dry (or stove and age) the coated test panels for the specified time under specified conditions. Unless otherwise specified condition them at $27 \pm 2^\circ\text{C}$ and a relative humidity 65 ± 5 percent for a minimum of 16 h, with free circulation of air and without exposing them to direct sunlight. Then carry out the test procedure as soon as possible.

3.4.4 Thickness of coating — Determine the thickness in micrometres, of the dry coating, by any appropriate method but using any one of the non-destructive procedures.

3.4.5 Preparation of scratch — If specified, make a scratch or scribed mark through the coating to the substrate. Unless otherwise specified, use the single cutting tool and locate the scratch at least 20 mm from any edge of the test panel.

3.5 Procedures

3.5.1 Method of exposure of test panels

3.5.1.1 The panels shall be so placed in the cabinet that they are not in direct line of travel of spray from the atomizer. Baffles may be used to prevent direct impact of the sprayed solution on the panels.

3.5.1.2 The angle at which each panel is exposed in the cabinet is very important. Each test surface shall be placed in the cabinet, facing upwards at an angle of 15° to the vertical.

Note — By agreement between the interested parties, it is sometimes necessary to expose the painted components of different shapes. When such tests are conducted, it is of particular importance to expose the shaped components in their normal attitude in use. Within this restriction, the component should be placed so as to minimize the disruption of flow. Furthermore, other test panels and components cannot be tested at the same time if the shape of the painted component interferes with the general direction of flow.

It should be noted that the degree of film breakdown with different aspects may vary and due consideration should be made in the interpretation of these results.

3.5.1.3 The panels shall be so arranged that they do not come into contact with one another or with the cabinet, and that the surfaces to be tested are exposed to the spray only where it is settling freely. Panels should be placed preferably at one level within the cabinet so that the solution cannot drip from the the panels or their supports at one level on to the other panels placed below.

Note — It may be advantageous to alter the position of the panels periodically, for example, at the inspection intervals (see 3.5.4). Any change, however, should be stated in the test report.

3.5.1.4 The support for the panels shall normally be racks made of inert non-metallic material, such as glass, plastics or suitably coated wood. If, exceptionally, it is necessary to suspend test panels, the material used shall on no account be metallic and shall be synthetic fibre, cotton thread or other inert insulating material.

3.5.2 Operating conditions

3.5.2.1 The measured temperature inside the spray cabinet shall be $35 \pm 2^\circ\text{C}$.

3.5.2.2 The solution collected in each of the collecting devices (3.2.4) shall have a sodium chloride concentration of 50 ± 10 g/l and a pH of 6.5 to 7.2 (see 3.3.2).

The average rate of collection of solution in each device measured over a minimum period of 24 h shall be 1 to 2 ml/h for a horizontal collecting area of 80 cm^2 .

3.5.2.3 Test solution which has been sprayed shall not be reused.

3.5.3 Carry out the determination in duplicate, unless otherwise specified.

3.5.3.1 Set up the apparatus as described in 3.5.2.

3.5.3.2 Arrange the test panels in the cabinet as described in 3.5.1.

3.5.3.3 Close the cabinet and start the flow of the test solution (see 3.3) through the atomizers (3.2.3). Continuously spray throughout the prescribed test period, except for a short daily

interruption (see 3.5.4) to inspect, re-arrange or remove the test panels to check and replenish the solution in the reservoir and to make necessary recordings as described in 3.5.2.

3.5.4 Examination of test panels — Periodic visual examination of the panels should be made but the surfaces under test shall not be damaged. Each periodic examination shall not exceed 60 min in any 24 h period and should, whenever possible, occur at the same time of the day. The panels shall not be allowed to become dry (see also the note under 3.5.1.2)

At the end of the specified test period, remove the panels from the apparatus and rinse with clean water to remove the residues of salt solution from the surface. Immediately examine the test surfaces for signs of deterioration, for example, blistering, staining, loss of adhesion, and creep of corrosion from scratch.

If required, keep the panels in the standard atmosphere for the specified period and examine the test surfaces for deterioration.

If it is required to examine the substrate for signs of attack, remove the coating by the specified method.

4. Artificial Sea Water Spray Test

4.1 This is a test for determination of resistance of paint films to artificial sea water spray condensation conditions.

4.2 Composition of Artificial Sea Water — Dissolve the specified weights of the following salts and make up with freshly distilled water to give 1 kg of the solution:

<i>Salt</i>	<i>Weight, g</i>
Sodium chloride (NaCl)	23.476
Magnesium chloride (MgCl ₂)	4.981
Sodium sulphate (Na ₂ SO ₄)	3.917
Calcium chloride (CaCl ₂)	1.102
Potassium chloride (KCl)	0.664
Sodium bicarbonate (NaHCO ₃)	0.192
Potassium bromide (KBr)	0.096
Boric Acid (H ₃ BO ₃)	0.026
Strontium chloride (SrCl ₂)	0.024
Sodium fluoride (NaF)	0.003
	<hr/>
	34.481
Water to make:	<hr/> 1 000.000 <hr/>

The artifical sea water thus prepared on thorough aeration produces a pH between 7.9 and 8.3 which is most suitable for the test.

4.3 Apparatus — The apparatus illustrated diagrammatically in Fig. 1 and 2 consists essentially of a chemically inert container with a close fitting cover in which a fine mist of the spray solution is produced through an atomizer in such a way that:

- a) the panels supported on non-metallic supports with the test face upwards at an angle of approximately 15° to the vertical, are evenly coated with droplets of the solution;
- b) the salt spray is prevented by a baffle from impinging directly on test faces of the panel; and
- c) salt solution drained from the test panels is not recirculated.

4.4 Procedure

4.4.1 prepare a panel of 150 × 100 × 1.25 mm mild steel plate as described in IS : 101 (Part 1/Sec 3)-1986 and stove in accordance with the relevant material specification. Keep at room temperature for 24 hours and expose it for 4 days to a baffled spray of the spray solution.

Remove 25 mm strip of the film from the centre of the panel along the length carefully with a suitable paint remover and examine the exposed metal for signs of corrosion, neglecting 25 mm portions of the exposed surface from each edge.

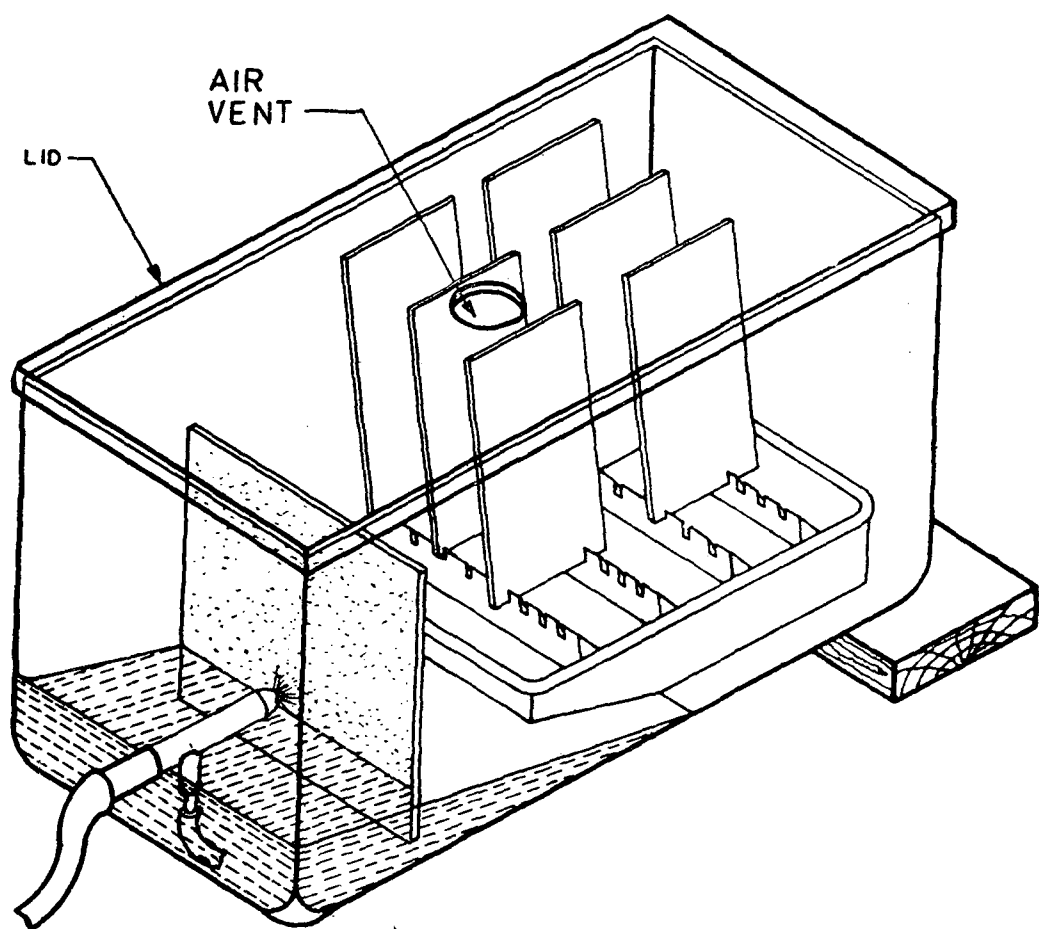


FIG. 1 SALT SPRAY APPARATUS

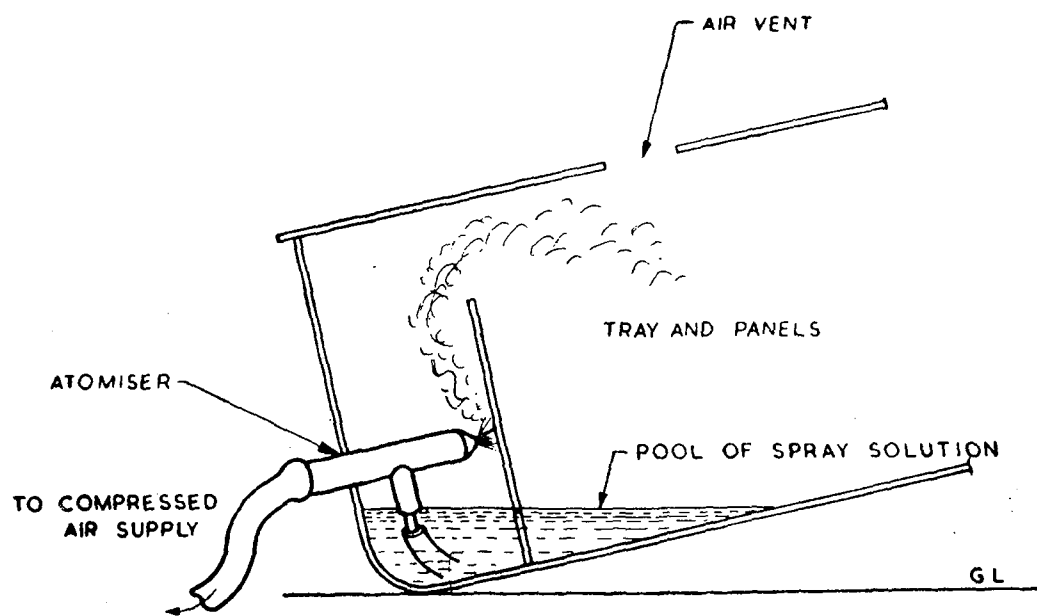


FIG. 2 PART SECTIONAL VIEW OF SALT SPRAY APPARATUS

EXPLANATORY NOTE

This standard is one of a series of the standards on methods of sampling and test for paints, varnishes and related products. In the preparation of this standard, considerable assistance has been taken from ISO 7253-1984 'Paints and varnishes — Determination of resistance to neutral salt spray', issued by the International Organization for Standardization (ISO). This standard supersedes 18 of IS : 101-1964 'Methods of test for ready mixed paints and enamels (second revision)'.